

# ANNUITIES: WHOSE CUP OF TEA?

BY JUNHAO LIU

## ABSTRACT

Annuity and guaranteed lifetime income products provide valuable protection against the risk of outliving one's retirement savings, yet the take-up of annuities is limited and below theoretical predictions by academic research. To shed light on this puzzle, I survey empirical studies from multiple disciplines on personal and household characteristics that influence consumer demand for annuities. I synthesize the literature in four areas: (1) demographic and economic factors, (2) rational consumer preferences, (3) behavioral impediments and the product design of annuities, and (4) financial literacy and cognitive ability in financial decision-making. Finally, I propose actionable items for the American retirement ecosystem and directions for future research.

## INTRODUCTION

This literature review aims to advance researchers', industry practitioners', and regulators' knowledge about consumer demand for annuities and guaranteed lifetime income<sup>1</sup>. While the classic economic literature predicts substantial take-up of annuities, many empirical studies find the participation rate to be well below the predicted level, a situation called the annuity puzzle. An important step in solving this puzzle is to understand the consumers' decision-making process when considering purchase of

an annuity. In this review I survey and synthesize the academic research frontier on key factors that influence the demand for annuities, drawing on empirical studies from multiple disciplines including economics, finance, insurance, marketing, and psychology. In addition to critiquing the methods and findings of studies that have been done, I make suggestions for future research, prioritizing the most actionable issues for the American retirement ecosystem.

This review consists of four sections. The first section reviews the demographic and economic factors that impact consumer demand for annuities. Identifying the key factors at play will help inform further research on the underlying mechanism that shapes demand for annuities. I evaluate the relation between annuity demand and the most important factors studied in the literature: annuitizable wealth, Social Security and other forms of pre-annuitized income, lifetime or preretirement level of income, age, gender, marital status, children, race and ethnicity, and education.

The second section examines the role of rational consumer preferences in making decisions about annuities. Rational preferences are the buyer characteristics typically included in life-cycle models of annuity demand in an expected utility framework. I review several preferences and parameters identified by prior research, including bequest motives, risk aversion, time preferences for future cash flows, and subjective life expectancy and health status.

1. This review focuses on immediate lifetime annuities that provide a stable income right after the purchase and continue as long as the annuitant is alive. For simplicity, I will use the term "annuity" for the rest of this review.

The third section covers behavioral impediments and the product design of annuities and life-protected income. The behavioral economics literature has found numerous biases and decision heuristics in personal finance decisions that are inconsistent with the classic rational models. In the context of annuity purchasing decisions, a prominent example of a behavioral impediment is the framing effect: people display a higher demand for an annuity when it is described as a product supporting future consumption rather than as an investment product. This section reviews the relevant consumer biases and heuristics in annuity decisions, as well as the product design and information framing by suppliers and regulators that can create or mitigate the behavioral barriers.

Recent research emphasizes the role of financial literacy and cognitive ability in financial decision-making, which I explore in the fourth section. To develop interventions that would help consumers overcome the behavioral impediments in purchasing annuities, I review relevant studies from this strand of literature and discuss the potential value of financial and pension literacy, cognitive ability, and other solutions that can be implemented in the American retirement ecosystem.

Finally, I offer some concluding remarks and suggest future research.

Throughout this literature review, I weight each study by my evaluation of its empirical soundness regarding research design and data quality. I give the highest credibility to studies that use actual consumer behavior, namely revealed preference data. Among those studies I prioritize data on observed ownership of annuities, followed by survey data on self-reported annuitization. I give less weight to stated preference data, which are hypothetical choices collected from survey and laboratory experiments. The advantage of revealed preference data is that they are actual decisions with high stakes and thus are more reliable for researchers. Because there is no guarantee that participants will make the same choices in the real world as the choices they report in the experiment, findings based on stated preference data are less credible, but still provide valuable insights. Importantly, when I discuss the effect of a potential

factor on annuity demand, other confounding factors have already been controlled for in the cited studies by research techniques such as multivariate regressions and randomized controlled trials.

## 1. DEMOGRAPHIC AND ECONOMIC FACTORS

Typical economic models of household finance predict that people make annuity-related decisions based on their annuitizable wealth, marital status, and age, among other factors. In this section, I review empirical findings about how demographic and economic factors affect consumer demand for annuities.

### 1.1. Annuitizable Wealth

The role of household wealth in determining annuity demand is multifaceted. First, an individual will need a minimum amount in cash to purchase the annuity product. Second, wealthy people may place less value on the longevity insurance embedded in annuities because they can self-insure against longevity risk, prefer to self-manage their retirement wealth, or want to leave bequests. I review annuitizable wealth in this subsection and discuss pre-annuitized wealth including Social Security in subsection 1.2<sup>2</sup>

Most studies using revealed preference data find a positive relation between annuitizable wealth and demand for annuities (Benartzi, Previtro, and Thaler 2011; Brown and Previtro 2020; Bütler, Staubli, and Zito 2013; Bütler and Teppa 2007). Among those, the studies by Benartzi, Previtro, and Thaler (2011) and Brown and Previtro (2020) are the most relevant since they have convincing large samples from the United States. In total, those two studies examine more than 130,000 choices between an annuity and a lump sum as the payout option from more than 100 defined-benefit plans in the United States.

Mottola and Utkus (2007) find that people with a higher account balance are less likely to annuitize, but their sample is limited to two defined-benefit plans. Banks, Crawford, and Tetlow (2015) find an insignificant rela-

2. Sometimes total household wealth is studied in a paper, which will be noted accordingly.

tion using data from the United Kingdom. Among the research using stated preference, several studies find a higher demand for annuities among wealthier consumers (Cappelletti, Guazzarotti, and Tommasino 2013; Chou et al. 2016; Hurd and Panis 2006;<sup>3</sup> Inkmann, Lopes, and Michaelides 2011;<sup>4</sup> van der Crujisen and Jonker 2019);<sup>5</sup> yet Brown (2001) and Guillemette et al. (2016) find a lower demand, and others do not find a significant wealth effect (Bateman et al. 2017; Bockweg et al. 2018;<sup>6</sup> Shu, Zeithammer, and Payne 2018). Notably, a significant inverse U-shaped wealth effect is found by Bütler and Teppa (2007), Chou et al. (2016), Lee (2016),<sup>7</sup> and Shu, Zeithammer, and Payne (2018).

Taken together, current evidence suggests that demand for annuities increases with a person's annuitizable wealth until a certain point and then decreases, displaying an inverse U-shaped relation between wealth and annuity demand.

## 1.2. Social Security and Other Pre-annuitized Incomes

Social Security accounts for more than half of the total income for those over age 65 in the United States (Banerjee 2013). There would be little need for private annuities if most of a consumer's wealth were already annuitized in the form of Social Security or other pension incomes (Dushi and Webb 2004). Many economic and insurance studies build theoretical models underscoring the important role of social insurance in annuity demand (Hong and Ríos-Rull 2007; Hosseini 2015; Purcal and Piggott 2008).

Using revealed preference data in the United States, Bernheim (1991) finds a significant negative relation between Social Security benefits and private annuity income. Banks, Crawford, and Tetlow (2015), in contrast, find in a UK sample that people with other private pension incomes are more likely to choose annuitization over income draw-downs. Using stated preference data, Chou et al. (2016), Guillemette et al. (2016), and Schreiber and Weber (2016) do not find the self-assessed chance of receiving Social Security benefits or other pension incomes to be related to annuity demand. This disagreement might be due to

the international differences in social insurance systems (Chou et al. 2016; Schreiber and Weber 2016) or sample composition (Guillemette et al. 2016).

Overall, despite theories predicting that those with higher pension benefits will demand fewer additional annuities, the empirical evidence on this matter is rather thin. A possible reason for the paucity of evidence is that it is difficult for researchers to access administrative data on Social Security wealth and annuity choices for the same sample.

## 1.3. Lifetime or Preretirement Level of Income

Besides wealth, the level of lifetime income or preretirement salary can also affect decisions people make about annuities. Annuities benefits are paid on a regular basis similar to a salary from a job, and therefore consumers might be thinking of the annuity product as a way of replacing a targeted share of the income they received while working.

Using revealed preference data, most studies provide convincing evidence of a positive effect of the level of personal lifetime income or preretirement income on annuity demand (Chalmers and Reuter 2012; Clark, Morrill, and Vanderweide 2014; Hagen 2015; Pfarr and Schneider 2013). Chalmers and Reuter (2012) examine the real choices between annuities and lump sums by more than 32,000 public employees in Oregon and find having a preretirement salary in the top quartile is significantly related to a higher demand for annuities. Previtero (2014) finds a negative effect of earning top-quartile salaries on the probability of choosing an annuity over a lump sum in a defined-benefit plan from IBM, but the average annual income in his sample (\$101,070) is much higher than in other studies. Mottola and Utkus (2007) analyze data on two Fortune 500 defined-benefit plans and find the effect of household income to be positive on annuitization choice for one plan and insignificant for the other. Similar to wealth, an inverse U-shaped relationship between income and annuity demand is found by Clark, Morrill, and Vanderweide (2014). Most studies using stated preference data do not find a strong effect of

3. Total household wealth is studied.

4. Total household wealth is studied.

5. For pensioners with pension rights only.

6. Total household wealth is studied.

7. Deferred annuities are studied.

personal or household income (Bockweg et al. 2018; Cappelletti, Guazzarotti, and Tommasino 2013; Chou et al. 2016; Guillemette et al. 2016; Nosi et al. 2017; Schreiber and Weber 2016; Shu, Zeithammer, and Payne 2018; Teppa and Lafourcade 2014). The only exception is van der Crujisen and Jonker (2019), who find pensioners (or retirees) in a Dutch survey who have a higher personal monthly income express greater willingness to receive part of their remaining pension as a lump sum.

Based on the reviewed studies, it appears that income level is positively associated with annuity demand. A possible explanation for the discrepancy between revealed preference and stated preference studies is that in revealed preference studies those with lower income still have the same willingness as the high earners to annuitize, but they do not do so because of financial constraints.

#### 1.4. Age

Assuming that age is priced in annuities in a way that takes into account the mortality risk by age, classic economic models predict that annuity demand should be independent of age. Still, retirement planning may evolve as people age due to social and psychological factors that are irrelevant to mortality risk.

Most studies with revealed preference data find a higher demand at an older age for claiming pension benefits (Benartzi, Previtro, and Thaler 2011; Brown and Previtro 2020; Bütler, Staubli, and Zito 2013;<sup>8</sup> Inkmann, Lopes, and Michaelides 2011;<sup>9</sup> Lee 2016;<sup>10</sup> Mottola and Utkus 2007). Clark, Morrill, and Vanderweide (2014) find a lower demand at older ages, but their sample is much younger (18–49) than the other studies. Others do not find a significant age effect (Hurwitz and Sade 2019; Pfarr and Schneider 2013; Previtro 2014).

A less clear picture arises as we turn to stated preference studies: many of them find age to be positively correlated with annuity purchase (Bockweg et al. 2018; Cappelletti, Guazzarotti, and Tommasino 2013; Chou et al. 2016; Teppa and Lafourcade 2014; van der Crujisen and Jonker 2019), whereas others find the opposite to be true

(Guillemette et al. 2016; Hurd and Panis 2006; Schreiber and Weber 2016), and some do not identify any effects (Beshears et al. 2014; Shu, Zeithammer, and Payne 2018).

Overall, the evidence suggests that older people are more likely to annuitize when they choose between annuities and lump sums for pension benefits. A possible reason why the relation is not always found in the research is that other economic and demographic factors like wealth, income, and gender may sometimes dominate the age effect.

#### 1.5. Gender

Gender effects on investment decisions and retirement wealth management have been widely documented in the literature (Agnew, Balduzzi, and Sunden 2003; Barber and Odean 2001; Dwyer, Gilkeson, and List 2002; Eckel and Grossman 2008; Sundén and Surette 1998). In this subsection I review current evidence on the relation between gender and annuity demand.

Among studies on revealed preference data, most find that women have a higher demand for annuities on average, and the gender difference is large (Benartzi, Previtro, and Thaler 2011; Brown and Previtro 2020; Chalmers and Reuter 2012; Clark, Morrill, and Vanderweide 2014; Lee 2016;<sup>11</sup> Mottola and Utkus 2007; Previtro 2014). For example, Brown and Previtro (2020) look at more than 27,000 employees from defined-benefit plans, among whom 42% chose an annuity over a lump sum at retirement; being female increases the predicted probability of choosing annuities by 4%. Several other studies find either an insignificant gender effect or mixed evidence (Hagen 2015; Hurd and Panis 2006; Hurwitz and Sade 2019; Schreiber and Weber 2016). In contrast, Bütler and Teppa (2007) and Inkmann, Lopes, and Michaelides (2011)<sup>12</sup> find that female pension fund members annuitize less in their data.

Research using stated preference data yields ambiguous evidence regarding the gender effect. For example, Beshears et al. (2014), and Shu, Zeithammer, and Payne (2018) do not find a significant effect of being female on

8. The sample consists of only men.

9. For stockholders only.

10. Deferred annuities are studied.

11. Deferred annuities are studied.

12. The effects are concentrated among stockholders.

annuity demand using survey data in the United States; studies using international data find similar results (Bateman et al. 2017; Bockweg et al. 2018; Cappelletti, Guazzarotti, and Tommasino 2013; Chou et al. 2016; Pfarr and Schneider 2013; van der Crujisen and Jonker 2019). Some studies find evidence supporting a positive relationship between being female and annuity demand (Agnew et al. 2008; Guillemette et al. 2016; Nosi et al. 2017). Agnew et al. (2008) focus on the role of gender. In an experiment on retirement investment choice, they find that women are more likely to prefer the annuity option to the option of investing on their own. On the other hand, Teppa and Lafourcade (2014) find, among their survey respondents, that women are less likely than men to purchase an annuity.

The overall evidence from prior studies suggests that, on average, women have a higher demand for annuities. An important caveat here is that with the gender-neutral pricing in a few key studies<sup>13</sup> (Brown and Previtore 2020; Chalmers and Reuter 2012), the value of annuities is higher for women than for men because women have a longer average life expectancy. This may explain the lower demand among women found by Bütler and Teppa (2007) and Teppa and Lafourcade (2014), in which gender is priced in annuities. Also, gender is often correlated with many socioeconomic and psychological factors, and past research finds a significant gender gap in financial literacy (Agnew and Szykman 2011; Bucher-Koenen et al. 2017; Fonseca et al. 2012). Thus, it is unsurprising that there is some disagreement in the literature.

## 1.6. Marital Status

Family and marriage can be viewed as a risk-sharing arrangement and therefore a substitute for formal insurance products including annuities (Brown and Poterba 2000). In this subsection I review the empirical evidence regarding the effects of marriage, and in the next subsection I focus on the effects of children.

Most studies using revealed preference data find a negligible effect from being married in determining annuity demand (Hagen 2015; Hurwitz and Sade 2019; Mottola and Utkus 2007). Pfarr and Schneider (2013) find that married people in Germany are more likely to purchase a subsidized annuity product. Regarding

stated preference, the evidence also suggests an insignificant effect of marital status (Beshears et al. 2014; Bockweg et al. 2018; Cappelletti, Guazzarotti, and Tommasino 2013; Guillemette et al. 2016; Inkmann, Lopes, and Michaelides 2011; Schreiber and Weber 2016; Shu, Zeithammer, and Payne 2018; van der Crujisen and Jonker 2019). Brown (2001) finds a negative effect from being married, but the effect disappears after controlling for annuity-equivalent wealth. The only exception is Bateman et al. (2017), who find a positive association between being married and allocating retirement wealth into annuities.

A few papers further distinguish between never married and divorced/widowed. Bockweg et al. (2018) find that being divorced or widowed has no effect, while Chou et al. (2016) find that those who never married have a higher demand. Studying employer-based pension data from Switzerland, Bütler and Teppa (2007) find that both married and divorced men have significantly lower demand for annuities compared to single men, and that married women have significantly higher demand.

In summary, the literature finds that being married by itself is not a strong predictor of annuity demand. A potential explanation for this discrepancy between theories and empirical findings is that, whereas couples have other financial protection from longevity risk, they also have greater retirement wealth to allocate, making them equally likely to choose annuities. Another reason is that the relative generosity of joint-and-survivor annuities compared to single-life annuities differs across the research data sets, and thus annuities might be more attractive to married people in some contexts but not in others.

## 1.7. Children

Having children can affect annuity demand in at least two ways. First, people spend substantial financial and time resources raising children; given the same lifetime income and wealth, people with children will have significantly less annuitizable retirement savings compared to those without children. At the same time, adult children can be a substitute for annuities in providing financial support for parents as they age. Second, the intention to leave bequests to children will also alter one's annuity holding because annuities cannot be inherited (Lockwood 2012)<sup>14</sup>

13. This information is not provided in most other studies using revealed preference data.

14. Annuities with a guarantee period are an exception.

The presence or number of children is found to be an insignificant factor regarding annuity demand in the literature using real choices (Hagen 2015; Inkmann, Lopes, and Michaelides 2011; Pfarr and Schneider 2013) and hypothetical demand (Beshears et al. 2014; Brown 2001; Cappelletti, Guazzarotti, and Tommasino 2013; Chou et al. 2016; Shu, Zeithammer, and Payne 2018; van der Cruijisen and Jonker 2019). Banks, Crawford, and Tetlow (2015) find having children is positively correlated with choosing annuities over other pension payout options in their UK data, and Bütler and Teppa (2007) find similar results with dependent children in a Swiss sample. In contrast, three other studies find the number of children to be negatively associated with annuity demand (Bockweg et al. 2018; Schreiber and Weber 2016; Teppa and Lafourcade 2014).

In sum, recent research evidence suggests that having children does not affect the demand for annuities. While this conclusion does not support the view that people who can count on family support demand fewer annuities, it might be explained by strategic bequest models in which parents optimize the division of bequests to influence children's actions such as care and attention (Bernheim, Shleifer, and Summers 1986).

### 1.8. Race and Ethnicity

There has been little research on whether race and ethnicity have any impact on the demand for annuity products. Brown (2001) does not find a significant effect of being non-white; Hurd and Panis (2006) find that Black people are more likely to cash out their pension entitlements when leaving their jobs than are white people or people of other races, though there are data misreporting concerns in the study.

### 1.9. Education

Education is often used as a proxy for financial or annuity literacy in research. First, better-educated people tend to have a more accurate understanding of the benefits of annuities; second, people with a higher education level have a higher average life expectancy and thus are likely to receive larger total payments from life annuities. Therefore, they might demand more annuities compared to those with a lower educational status.

Using revealed preference data, Banks, Crawford, and Tetlow (2015), Brown (2001), Hurd and Panis (2006), and Pfarr and Schneider (2013)<sup>15</sup> do not find education to be an effective predictor of annuity demand, while Inkmann, Lopes, and Michaelides (2011) and Hagen (2015) find the education level to be positively associated with annuity demand. Previtro (2014) finds a negative effect of the years of education on the probability of annuitization in an IBM defined-benefit plan, but the average years of education in his sample is 15.22, which is not representative of the general population. As to stated preference studies, most papers do not find education to be a significant factor (Beshears et al. 2014; Chou et al. 2016; Guillemette et al. 2016; Nosi et al. 2017; Schreiber and Weber 2016; van der Cruijisen and Jonker 2019). Studies by Bateman et al. (2017) and Cappelletti, Guazzarotti, and Tommasino (2013) are two exceptions that found a positive effect in their sample.

Overall, evidence from current literature suggests a minimal impact of educational attainment on annuity demand. This could be explained by the fact that most studies have already controlled for other important factors such as wealth, income, gender, and age.

### 1.10. Summary

Much research to date has been focused on the role of various economic and demographic characteristics in determining annuity demand. The most salient characteristics are annuitizable wealth, lifetime or preretirement income, age at which people make annuitization decisions, and gender. Other factors, including pre-annuitized wealth, family, and education, are not found to be relevant in the empirical literature.

## 2. RATIONAL CONSUMER PREFERENCES

Within the rational expected-utility framework of decision-making in economics, several factors in consumer preferences have been proposed and tested to explain annuity demand. This section reviews the empirical findings on these rational factors: bequest motives, risk aversion, time

15. Pfarr and Schneider (2013) find a positive effect of high school education (compared to no secondary school) for un-subsidized pensions, but no effect of having a college degree.

preferences for future cash flows, subjective life expectancy and health status, and trust in annuity providers.

## 2.1. Bequest Motives

The intention to leave a bequest to one's beneficiaries after death is frequently proposed as a major reason to explain the lower-than-expected annuitization rate in the theoretical literature (Ameriks et al. 2011; Brown 2001; Friedman and Warshawsky 1990; Inkmann, Lopes, and Michaelides 2011; Lockwood 2012).

In the empirical literature, the bequest intention is rarely studied using revealed preference data; an exception is Banks, Crawford, and Tetlow (2015), who find the ownership of life insurance, a proxy for the bequest motives, is not significantly related to annuitization. This finding is echoed by most research that use stated preference data (Shu, Zeithammer, and Payne; Teppa and Lafourcade 2014; van der Crujisen and Jonker 2019). Among them the most convincing one is probably Brown (2001), who does not find a significant effect of self-reported importance of leaving an inheritance on intended annuitization. In contrast, Bateman et al. (2017) find a negative effect of bequest intention on annuity demand; Chou et al. (2016) find that self-reported bequest motives toward family members increase the stated demand for an annuity product, but the annuity in their study has a 10-year period-certain guarantee, which reduces the trade-off between annuities and bequests.

Overall, research on this topic does not find a strong effect of bequest motives on annuity demand. However, most of the studies use self-reported intention to purchase annuities in surveys instead of actual choices. Ideally, future research can overcome the challenge of quantifying the bequest motives using administrative data and answer this question more convincingly by using revealed preference data.

## 2.2. Risk Aversion

Economic theories generally predict a positive effect of risk aversion on annuity demand, since an annuity is more attractive to risk-averse people for its income protection at older ages (Brown 2001; Brown and Poterba 2000; Büttler and Teppa 2007).

Like bequest motives, risk aversion is rarely measured in revealed preference data, with the exception of the study by Pfarr and Schneider (2013), who use German household survey data and do not find a large impact of risk aversion on annuity ownership. If we turn to research on stated preference, a few studies find a positive effect (Bockweg et al. 2018; van der Crujisen and Jonker 2019), while some find a negative effect (Guillemette et al. 2016; Knoller 2016; Shu, Zeithammer, and Payne 2018), and others do not find a significant effect at all (Cappelletti, Guazzarotti, and Tommasino 2013; Chou et al. 2016; Schreiber and Weber 2016). Interestingly, Agnew et al. (2008) find a positive effect of risk aversion on annuity demand for men but a negative effect for women, which highlights the gender difference.

Thus, empirical literature has not made it clear whether risk aversion will increase or decrease annuity demand. One possible reason for this lack of clarity is that the measure of risk aversion differs across studies; another reason is the correlation between risk aversion and many other factors, including annuitizable wealth, age, gender, and education, among other factors.

## 2.3. Time Preferences for Future Cash Flows

The economics literature documents a key role of time preferences (i.e., the discount rate of future cash flows, in financial decisions) (Angeletos et al. 2001; Laibson 1997). Since annuity products involve resource exchange across time, time preferences are an integral part of annuity purchase decisions. In the literature, time preferences are sometimes termed as impatience or myopic attitudes in financial planning. For reference, using the Health and Retirement Study data in the United States, Brown (2001) finds 17% of the sample report a financial planning horizon no longer than one year; importantly, the annuitization choices by this group of people are not well explained by his life-cycle model.

All relevant studies have so far used only stated preference data. Using international survey data, Bockweg et al. (2018), Cappelletti, Guazzarotti, and Tommasino (2013), and van der Crujisen and Jonker (2019)<sup>16</sup> find that people who are more patient have a higher demand for annuities.

16. In this study, patience is found to be a significant factor only for the preretirement sample when choosing between an annuity and a lump-sum option.

## 2.4. Subjective Life Expectancy and Health Status

The total annuity payment received by an annuity owner is determined by how long she lives after the purchase is made. Thus, a potential annuity buyer should naturally evaluate her subjective life expectancy and health status when making a decision regarding annuities.<sup>17</sup> In the literature, self-evaluated survival probability until a specific age is widely used to capture this factor.

Most studies using revealed preference data do not find a strong relationship between subjective longevity and annuity demand (Brown 2001; Hurd and Panis 2006; Inkmann, Lopes, and Michaelides 2011; Pfarr and Schneider 2013). An exception is Banks, Crawford, and Tetlow (2015), who find that people who report a subjective life expectancy in the lowest quartile of the distribution prefer an income drawdown option over annuities, but the level of statistical significance is weak ( $p = 0.1$ ). The same study also examines the survival experience of the respondent's parents within 10 years of the respondent's age, a potential proxy for subjective life expectancy, and find an insignificant relation. This contrasts with Hagen (2015) who finds that having a longer-lived same-sex parent increases an individual's preference for annuities compared to fixed-term payouts. Among the studies using stated preference data, most report a positive relationship between one's subjective life expectancy and demand for annuities (Bockweg et al. 2018; Payne et al. 2013; Schreiber and Weber 2016; Teppa and Lafourcade 2014; van der Crujisen and Jonker 2019);<sup>18</sup> yet others do not find an economically significant effect (Bateman et al. 2017; Chou et al. 2016; Shu, Zeithammer, and Payne 2018).

Similar to subjective longevity, personal evaluation of one's own health status can affect annuity demand. Using revealed preference data from the United States, Brown (2001) and Hurd and Panis (2006) report that self-reported health is positively associated with annuity purchase, whereas Wuppermann (2017) does not find a significant effect. At the same time, most studies using stated preference data do not find a strong effect of subjective health status (Bockweg et al. 2018; Cappelletti, Guazzarotti, and Tommasino 2013; Chou et al. 2016; Shu, Zeithammer, and Payne 2018; van der Crujisen and Jonker 2019).

The literature suggests little effect of subjective life expectancy and health on annuity demand. The insignificant effect may be attributed to the inability of people to consider this factor in annuity choices and other contextual factors in different samples.

## 2.5. Trust in Annuity Providers

If consumers perceive a high risk of the annuity provider's becoming insolvent and defaulting on the annuity payments, it might be rational for them not to annuitize, even if they would be better off with annuitization without the insolvency risk (Hanewald, Piggott, and Sherris 2013; Peijnenburg, Nijman, and Werker 2016). Another matter related to the insolvency risk of annuity providers is people's trust in the providers.

Only two stated preference empirical studies to date have investigated the effect of individual trust in providers on annuity demand. Both Bockweg et al. (2018) and van der Crujisen and Jonker (2019) study Dutch survey experimental data and find people who have more trust in their pension fund are more likely to annuitize.

## 2.6. Summary

Despite their importance in economic models, the existing empirical research on bequest motives, risk aversion, and time preferences for future cash flows in the context of annuitization choices is still quite thin. We need more studies using revealed preference data to provide more-convincing evidence. The relation between annuity demand and subjective life expectancy and health status is shown to be positive. Finally, although trust in annuity providers is rarely studied, improving consumer trust in annuity providers might be a way to boost the demand.

# 3. BEHAVIORAL IMPEDIMENTS AND THE PRODUCT DESIGN OF ANNUITIES

A wide array of recent research emphasizes the role of behavioral biases in consumer financial decision-making (Agarwal, Chomsisengphet, and Lim 2017; Thaler

17. This may lead to adverse selection in the annuity market (Finkelstein and Poterba 2002, 2004), which is not covered in this review.

18. This is true only for the preretirement sample when choosing between an annuity and a lump sum option.

and Sunstein 2009). This section surveys relevant studies on the potential behavioral impediments to annuity demand and how product design could alleviate or exacerbate some of these issues.

### 3.1. Consumer Biases

Since the seminal work on behavioral economics by Kahneman and Tversky (1979), numerous consumer biases have been found to affect household finance decisions (Campbell et al. 2011) and annuitization in particular (Benartzi, Previtro, and Thaler 2011; Hu and Scott 2007; Knoller 2016).

First, the thought of one's own death—termed mortality salience—may change people's preferences. Through four experiments, Salisbury and Nenkov (2016) find a strong negative effect of mortality salience on annuity demand. Payne et al. (2013) explore the framing effect in self-reported survival probabilities and find the median expected age at death is higher by ten years when people think in a “I will live to be X years old or older” frame compared to a “I will die at X years old or younger” frame. They also find that the effect of subjective life expectancy is stronger when individuals think in the “live to” frame. In addition, Beshears et al. (2014) find in a survey experiment that people report a lower annuity demand after seeing a mortality chart that shows survival probabilities until certain ages (from 70 to 100).

Second, overconfidence is also a common bias among consumers. Overestimating one's ability to self-manage retirement wealth may lead to a reduction of annuity demand; Goedde-Menke, Lehmsiek-Starke, and Nolte (2014) confirm this prediction with revealed preference data.

Third, excessive extrapolation of recent investment returns into the future is found to influence annuity demand. Previtro (2014) provides a detailed analysis of this issue using data from more than 100 defined-benefit plans in the United States and finds evidence of people extrapolating past stock market returns in annuitization choices. This finding is confirmed by Agnew, Anderson, and Szykman (2015) in a large-scale experiment.

Finally, a recent study by Brown and Previtro (2020) finds that procrastination is related to a lower demand for annuities.

Hu and Scott (2007) propose a list of behavioral biases that might be relevant in annuitization, including mental accounting, cumulative prospect theory, availability heuristics, and so on. We have reviewed the biases studied by the empirical literature to date and we expect more research to improve our understanding of how these biases impact annuity demand.

### 3.2. Product Design

Closely related to consumer biases, another stream of research explores how product design features, especially the framing effect and default effect, shape annuity demand.

First, it matters to potential buyers whether annuities are framed as a source of income to support future consumption or as an investment product. A possible explanation for this framing effect is the different risk perceptions induced by the two frames. When people perceive an annuity in a consumption frame, it works as an insurance to protect people from the risk of outliving their savings. When they think of an annuity in an investment frame, they see the possibility of dying prematurely and thus losing the money to the annuity provider as a risk.

Benartzi, Previtro, and Thaler (2011) examine this question by exploiting the different perceptions of defined-benefit plans and cash balance plans in a large administrative data set. They find that those in a cash balance plan (investment frame) are 17 percentage points less likely to choose an annuity when making a payout decision. Mottola and Utkus (2007) study the choice of benefit distributions from two defined-benefit plans and find a much higher annuitization rate in the traditional, final-average-pay plan than in the cash balance plan, though this finding is made without controlling for other factors. Other studies, using stated preference data, confirm that investment framing reduces the demand for annuities (Agnew et al. 2008; Beshears et al. 2014;<sup>19</sup> Bockweg et al. 2018;<sup>20</sup> Brown, Casey, and Mitchell 2008; Brown et al. 2013).

19. The authors find a negative effect of investment frame that is significant on the percentage of the annuitized balance, but not significant on the decision to annuitize.

20. The effect is from annuities framed as an investment tool with a potential loss.

Second, the default effect (i.e., people are more likely to choose the default option in a choice scenario) is often at play in decision-making (Beshears et al. 2007; Thaler and Sunstein 2009). If there is a default effect in retirement income arrangements, we expect a higher demand for annuities when the annuity option is the default.

The empirical literature provides some confirmation of this prediction. Using administrative data, Bütler and Teppa (2007) find evidence suggesting a strong default effect in decisions by Swiss employees to annuitize pension wealth, and Bütler, Staubli, and Zito (2013) report a default effect in the sensitivity of annuitization decisions with respect to price changes. In contrast, Mottola and Utkus (2007) find that even if the annuity option is the default, people sometimes actively de-annuitize from the default annuity option in their defined-benefit plan. Using data on stated choices, Bateman et al. (2017) and Bockweg et al. (2018) confirm the default effect. Agnew et al. (2008) do not find a strong default effect, yet the default option in their experiment is likely not very strong. In their experiment, the participants needed to make immediate choices to finish the trial. This is unlike the real world where people usually are not pressed to make an active choice in pension benefit distribution since the default option (an annuity or a lump sum) will still be executed for them by the pension fund.

Current research highlights the importance of product framing and the default effect in shaping annuity demand. Since future research might identify other behavioral biases in this context, it is worth exploring corresponding product design features that induce or protect annuity buyers from these biases. Consumer engagement is another potential way to mitigate behavioral barriers in annuity product design. Bateman et al. (2019) measure consumers' engagement in an annuity-learning task in an experiment. In their study, more-engaged participants' annuity valuation is less likely to be influenced by endowment effect and the pension system in their home country.

### 3.3 Summary

Behavioral impediments and product design have been the focus of recent literature on consumer finance and protection. Although research in this area provides many insights about consumer annuity demand and underscores the importance of these factors in policymaking and product design, it also brings new questions to be answered by future research.

## 4. FINANCIAL LITERACY AND COGNITIVE ABILITY IN FINANCIAL DECISION-MAKING

Personal financial decisions people face today are often complex and difficult. Decision-making requires a set of specific cognitive abilities and knowledge, especially with products like annuities that involve complicated features. Another reason to be worried about cognitive factors in retirement wealth management is that cognitive skills usually decline as people age. Since people are expected to work longer and to postpone retirement until later in life, the annuitization decision is often delayed to an older age when retirees might have weaker cognitive skills. The final section of the review focuses on financial and pension literacy, and cognitive ability, two prominent consumer attributes for helping people make better annuity decisions.

### 4.1. Financial and Pension Literacy

In the past two decades, financial literacy, the ability to understand and navigate through financial decisions, has attracted much attention from regulators and scholars regarding its role in personal finance (Behrman et al. 2012; Fernandes, Lynch, and Netemeyer 2014; Lusardi and Mitchell 2014; Kaiser et al. 2020), and retirement planning in particular (Mitchell and Lusardi 2011; van Rooij, Lusardi, and Alessie 2012). Financial literacy may have a positive impact on the demand for annuities if more-literate people can better understand the unique benefits of annuities compared to other retirement income products.

Most empirical studies do not find a clear relationship between financial literacy and annuity demand (Banks, Crawford, and Tetlow 2015; Bateman et al. 2017; Bockweg et al. 2018; Cappelletti, Guazzarotti, and Tommasino 2013; Shu, Zeithammer, and Payne 2018). Schreiber and Weber (2016), using stated preference data, find that people with a higher financial literacy level have higher demand for annuity in a retirement planning scenario. Agnew et al. (2008) and Chou et al. (2016) find the opposite, but Chou et al. (2016) also control for annuity-specific knowledge in the analysis. In addition to the studies measuring objective financial literacy by people's performance in answering relevant questions, Bateman et al. (2017) and Bockweg et al. (2018) find that self-assessed financial literacy is negatively related to annuity demand, and this negative relation might be linked to over-confidence.

Two related studies look at other effects of financial literacy on retirement planning, and find that those with a higher financial literacy make more-consistent evaluations of annuities (Brown et al. 2017) and display higher consistency in time preferences (Schreiber and Weber 2016).

A few studies measure pension literacy, focusing on consumer knowledge about pensions other than general financial literacy (Cappelletti, Guazzarotti, and Tommasino 2013; Chou et al. 2016; Landerretche and Martínez 2013). Among them, Cappelletti, Guazzarotti, and Tommasino (2013) do not find a strong effect of pension knowledge on annuity demand, and Chou et al. (2016) find a positive impact of annuity-specific knowledge after controlling for financial literacy.

The literature does not find a clear effect of financial and pension literacy on annuity demand. This might be because people with higher literacy still need to spend considerable time understanding and comparing different retirement income products. For example, in two experimental studies, Bateman et al. (2019) do not find general financial literacy to be a strong predictor of annuity valuation and Bateman et al. (2018) find that financial literacy does not improve people's risk management performance in retirement planning. Also, current measures of general financial literacy might not reflect an individual's ability to choose the right level of annuitization.

## 4.2. Cognitive Ability

The recent development in consumer finance research finds cognitive ability to be a strong predictor of financial decisions and wealth accumulation (Agarwal and Mazumder 2013; Banks, O'Dea, and Oldfield 2010; Johnston, Kassenboehmer, and Shields 2016; Smith, McArdle, and Willis 2010).

Brown et al. (2017) identify the evaluation of annuities as a cognitive challenge to people. The authors ask survey respondents to evaluate an annuity by reporting the price at which they are willing to buy it and the price at which they are willing to sell it. The paper finds that, on average, people's selling price is much lower than their buying price of the same annuity, which is evidence of an inability to value annuities. The authors also pro-

pose a cognitive index, defined as the first principal component of three measures of cognition: financial literacy, numeracy, and education;<sup>21</sup> and find that people with a higher cognitive index have a narrower sell-buy spread on average. Brown et al. (2019) further develop the stream of research with an experimental study. By varying the complexity of the annuitization decision, they find causal evidence that people's ability to evaluate an annuity is indeed reduced by the decision complexity. In addition, Brown et al. introduce an intervention of a consequential message in the experiment, which provides people with a message describing an interaction between a vignette person and her financial advisor. In the message, the advisor explains the benefits and drawbacks of spending down retirement savings relatively quickly versus relatively slowly. The authors find this intervention helps to boost the ability to evaluate annuities among participants.

Two other studies look at the relation between cognitive ability and annuity demand. Agnew and Szykman (2011) run a large-scale experiment and find that people with higher self-reported cognitive overload are more likely to prefer the annuity option to the investment option in a retirement game setting. Banks, Crawford, and Tetlow (2015) measure cognitive ability by retrospective memory and executive function tasks, and find that neither measure is a strong predictor of annuity demand.

The literature on the role of cognitive ability in annuity choices is still thin although it is growing quickly. No studies thus far, however, have examined other types of cognitive abilities including loss of judgment. Given the current evidence, it appears a promising avenue for future research.

## 4.3. Summary

In the literature, financial literacy and pension literacy are not found to be strong predictors of annuity demand. More research is needed to explore better ways to measure them in the context of annuitization. There is some evidence suggesting the potential role of cognitive ability, which calls for more studies to extend our knowledge to different aspects of cognitive ability in addition to current measures, such as education and numeracy.

21. Principal component analysis is a technique in statistical analysis used to reduce the number of dimensions in data. The principal component vector is derived to retain the most information possible from a list of vectors. This review focuses on immediate lifetime annuities that provide a stable income right after the purchase and continue as long as the annuitant is alive. For simplicity, I will use the term "annuity" for the rest of this review.

## CONCLUDING REMARKS AND FUTURE RESEARCH

In the past 20 years we have seen substantial achievements in understanding the role of sociodemographic factors including household wealth, lifetime or preretirement income, age, and gender in the decision-making process for annuities. Even though many questions remain and there is often disagreement on the role of these factors among studies examined in this literature review, rigorous research exploiting a wide range of data across the world provides reliable evidence for researchers, the annuity industry, and policymakers. In the following subsections I recommend actionable items for the American retirement ecosystem and propose directions for future research.

### Actionable Items for the American Retirement Ecosystem

Based on the findings from current research, the following improvements are worth consideration for providers and regulators in the American retirement ecosystem.

First, consumer education and engagement are warranted to overcome the behavioral obstacles in the annuitization decision. Finding the right way to improve consumer knowledge of annuity products could help consumers overcome the cognitive challenge of understanding and choosing retirement income products. Independent third-party advice may also be a more cost-effective solution. Among the behavioral impediments found in the literature, the framing effect is of particular importance. The annuity industry and regulators can explore psychological interventions that encourage consumers to think of annuities in a consumption frame. In addition, trust in annuity providers should be a major goal for consumer engagement effort.

Second, while different types of annuities are available on the market, product innovation remains a promising way to help better address the variety of consumer demand for financial protection at older ages, as well as other preferences such as bequest motives. An example is deferred annuities, which sell at a lower price than immediate annuities since the benefit payments of a deferred annuity do not start until a certain age. As a result, deferred annuities would be attractive to people with lower levels of retire-

ment wealth who still want to insure against the risk of outliving their savings. But as Mackenzie (2019) points out, consumers will forgo a higher return embedded in immediate annuities if they choose deferred annuities. Annuities with a guarantee period may also be attractive for those with a strong (and altruistic) bequest intention.

### Future Research

Despite the extensive literature on the annuity puzzle in general and much research on consumer characteristics in shaping annuity demand, there are still many open questions to be answered. I recommend the following directions for future research, drawing on the findings from past literature and reviews by Alexandrova and Gatzert (2019), Benartzi, Previtro, and Thaler (2011), Lambregts and Schut (2020) and Ramsay and Oguledo (2018).

First, regarding rational preferences, it remains a challenge to collect accurate administrative data and make more-convincing discoveries regarding the role of bequest motives, risk aversion, time preferences, and trust in providers in affecting annuity demand. A deeper understanding of these factors will help close the gap between the theoretical prediction of annuitization rates and empirical findings.

Second, the insights from behavioral economics have generated as many new questions as answers to the annuity puzzle. With many psychological biases that potentially have a role in annuitization choices, much research needs to be done to advance our understanding of this topic.

Finally, future research should advance our understanding of the roles of financial literacy and cognitive ability in annuitization decisions. We still do not know enough about whether financial literacy or annuity-specific knowledge helps people make better decisions about annuities. With recent progress in the research on cognitive ability and annuitization evaluation, it would be exciting to see more studies exploring different aspects of cognitive ability in this context.

## AUTHOR

Junhao Liu is a postdoctoral research associate at the University of Sydney, Australia. The views expressed in this review are those of the author and do not necessarily reflect the views of the University of Sydney.

## REFERENCES

Agarwal, Sumit, Souphala Chomsisengphet, and Cheryl Lim. 2017. "What Shapes Consumer Choice and Financial Products? A Review." *Annual Review of Financial Economics* 9 (1): 127–46. <https://doi.org/10.1146/annurev-financial-110716-032417>.

Agarwal, Sumit, and Bhashkar Mazumder. 2013. "Cognitive Abilities and Household Financial Decision Making." *American Economic Journal: Applied Economics* 5 (1): 193–207. <https://doi.org/10.1257/app.5.1.193>.

Agnew, Julie R., Lisa R. Anderson, Jeffrey R Gerlach, and Lisa R Szykman. 2008. "Who Chooses Annuities? An Experimental Investigation of the Role of Gender, Framing, and Defaults." *American Economic Review* 98 (2): 418–22. <https://doi.org/10.1257/aer.98.2.418>.

Agnew, Julie R., Lisa R. Anderson, and Lisa R. Szykman. 2015. "An Experimental Study of the Effect of Market Performance on Annuitization and Equity Allocations." *Journal of Behavioral Finance* 16 (2): 120–29. <https://doi.org/10.1080/15427560.2015.1034857>.

Agnew, Julie, Pierluigi Balduzzi, and Annika Sunden. 2003. "Portfolio Choice and Trading in a Large 401(k) Plan." *American Economic Review* 93 (1): 43. <https://doi.org/10.1257/000282803321455223>.

Agnew, Julie, and Lisa Szykman. 2011. "Annuities, Financial Literacy, and Information Overload." In Mitchell and Annamaria Lusardi, *Financial Literacy*, chap. 9.

Alexandrova, Maria, and Nadine Gatzert. 2019. "What Do We Know About Annuitization Decisions?" *Risk Management and Insurance Review* 22 (1): 57–100. <https://doi.org/10.1111/rmir.12115>.

Ameriks, John, Andrew Caplin, Steven Laufer, and Stijn Van Nieuwerburgh. 2011. "The Joy of Giving or Assisted Living? Using Strategic Surveys to Separate Public Care Aversion from Bequest Motives." *Journal of Finance* 66 (2): 519–61. <https://doi.org/10.1111/j.1540-6261.2010.01641.x>.

Angeletos, George-Marios, David Laibson, Andrea Repetto, Jeremy Tobacman, and Stephen Weinberg. 2001. "The Hyperbolic Consumption Model: Calibration, Simulation, and Empirical Evaluation." *Journal of Economic Perspectives* 15 (3): 47–68. <https://doi.org/10.1257/jep.15.3.47>.

Banerjee, Sudipto. 2013. "Income Composition, Income Trends, and Income Shortfalls of Older Households." Issue Brief 383, Employee Benefit Research Institute, Washington, DC. [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2222186](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2222186).

Banks, James, Rowena Crawford, and Gemma Tetlow. 2015. "Annuity Choices and Income Drawdown: Evidence from the Decumulation Phase of Defined Contribution Pensions in England." *Journal of Pension Economics and Finance* 14 (4): 412–38. <https://doi.org/10.1017/S1474747215000256>.

Banks, James, Cormac O’Dea, and Zoë Oldfield. 2010. "Cognitive Function, Numeracy and Retirement Saving Trajectories." *Economic Journal* 120 (548): F381–410. <https://doi.org/10.1111/j.1468-0297.2010.02395.x>.

Barber, Brad M., and Terrance Odean. 2001. "Boys Will Be Boys: Gender, Overconfidence, and Common Stock Investment." *Quarterly Journal of Economics* 116 (1): 262–92. [https://doi.org/10.1016/S0169-2070\(03\)00031-1](https://doi.org/10.1016/S0169-2070(03)00031-1).

Bateman, Hazel, Christine Eckert, Fedor Iskhakov, Jordan Louviere, Stephen Satchell, and Susan Thorp. 2017. "Default and Naive Diversification Heuristics in Annuity Choice." *Australian Journal of Management* 42 (1): 32–57. <https://doi.org/10.1177/0312896215617225>.

Bateman, Hazel, Christine Eckert, Fedor Iskhakov, Jordan Louviere, Stephen Satchell, and Susan Thorp. 2018. "Individual Capability and Effort in Retirement Benefit Choice." *Journal of Risk and Insurance* 85 (2): 483–512. <https://doi.org/10.1111/jori.12162>.

Bateman, Hazel, Jennifer Alonso Garcia, Eduard Ponds, and Ralph Stevens. 2019. "Learning to Value Annuities: The Role of Information and Engagement." [http://ire.hec.ca/wp-content/uploads/2019/11/Bateman-et-al\\_Learning-to-value-annuities\\_2019.pdf](http://ire.hec.ca/wp-content/uploads/2019/11/Bateman-et-al_Learning-to-value-annuities_2019.pdf).

Behrman, Jere R., Olivia S. Mitchell, Cindy K. Soo, and David Bravo. 2012. "How Financial Literacy Affects Household Wealth Accumulation." *American Economic Review* 102 (3): 300–304. <https://doi.org/10.1257/aer.102.3.300>.

Benartzi, Shlomo, Alessandro Previtero, and Richard H. Thaler. 2011. "Annuitization Puzzles." *Journal of Economic Perspectives* 25 (4): 143–64. <https://doi.org/10.1257/jep.25.4.143>.

Bernheim, B. Douglas. 1991. "How Strong Are Bequest Motives? Evidence Based on Estimates of the Demand for Life Insurance and Annuities." *Journal of Political Economy* 99 (5): 899–927. <https://doi.org/10.1086/261783>.

Bernheim, B. Douglas, Andrei Shleifer, and Lawrence H. Summers. 1986. "The Strategic Bequest Motive." *Journal of Labor Economics* 4 (3): 151–82. <https://doi.org/10.1086/298126>.

Beshears, John, James J. Choi, David Laibson, and Brigitte C. Madrian. 2007. "The Importance of Default Options for Retirement Saving Outcomes: Evidence from the USA." In *Lessons from Pension Reform in the Americas*, edited by Stephen J. Kay and Tapen Sinha, 59–87. Oxford, UK: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199226801.003.0004>.

Beshears, John, James J. Choi, David Laibson, Brigitte C. Madrian, and Stephen P. Zeldes. 2014. "What Makes Annuitization More Appealing?" *Journal of Public Economics* 116 (August): 2–16. <https://doi.org/10.1016/j.jpubeco.2013.05.007>.

Bockweg, Christian, Eduard Ponds, Onno Steenbeek, and Joyce Vonken. 2018. "Framing and the Annuitization Decision—Experimental Evidence from a Dutch Pension Fund." *Journal of Pension Economics and Finance* 17 (3): 385–417. <https://doi.org/10.1017/S147474721700018X>.

Brown, Jeffrey R. 2001. "Private Pensions, Mortality Risk, and the Decision to Annuitize." *Journal of Public Economics* 82 (1): 29–62. [https://doi.org/10.1016/S0047-2727\(00\)00152-3](https://doi.org/10.1016/S0047-2727(00)00152-3).

Brown, Jeffrey R., Jeffrey R. Kling, Sendhil Mullainathan, and Marian V. Wrobel. 2013. "Framing lifetime income." *The Journal of Retirement* 1(1): 27–37. <https://doi.org/10.3905/jor.2013.1.1.027>

Brown, Jeffrey R., Marcus D. Casey, and Olivia S. Mitchell. 2008. "Who Values the Social Security Annuity? New Evidence on the Annuity Puzzle." Working Paper 13800, National Bureau of Economic Research, Cambridge, MA. [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1092850](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1092850).

Brown, Jeffrey R., Arie Kapteyn, Erzo F. P. Luttmer, and Olivia S. Mitchell. 2017. "Cognitive Constraints on Valuing Annuities." *Journal of the European Economic Association* 15 (2): 429–62. <https://doi.org/10.1093/jeea/jvw009>.

Brown, Jeffrey R., Arie Kapteyn, Erzo F.P. Luttmer, Olivia S. Mitchell, and Anya Samek. 2019. "Behavioral Impediments to Valuing Annuities: Complexity and Choice Bracketing." *Review of Economics and Statistics* (December), 1–45. [https://doi.org/10.1162/rest\\_a\\_00892](https://doi.org/10.1162/rest_a_00892).

Brown, Jeffrey R., and James M. Poterba. 2000. "Joint Life Annuities and Annuity Demand by Married Couples." *Journal of Risk and Insurance* 67 (4): 527–53. <https://doi.org/10.2307/253849>.

Brown, Jeffrey R, and Alessandro Previtiero. 2020. "Saving for Retirement, Annuities, and Procrastination." Working Paper. Netspar Pension Conference Leiden, Netherlands. [https://www.netspar.nl/assets/uploads/20200122\\_pres\\_brown\\_previtiero\\_procrastination.pdf](https://www.netspar.nl/assets/uploads/20200122_pres_brown_previtiero_procrastination.pdf).

Bucher-Koenen, Tabea, Annamaria Lusardi, Rob Alessie, and Maarten van Rooij. 2017. "How Financially Literate Are Women? An Overview and New Insights: How Financially Literate Are Women? An Overview and New Insights." Journal of Consumer Affairs 51 (2): 255–83. <https://doi.org/10.1111/joca.12121>.

Bütler, Monika, Stefan Staubli, and Maria Grazia Zito. 2013. "How Much Does Annuity Demand React to a Large Price Change?" Scandinavian Journal of Economics 115 (3): 808–24. <https://doi.org/10.1111/sjoe.12022>.

Bütler, Monika, and Federica Teppa. 2007. "The Choice between an Annuity and a Lump Sum: Results from Swiss Pension Funds." Journal of Public Economics 91 (10): 1944–66. <https://doi.org/10.1016/j.jpubeco.2007.09.003>.

Campbell, John Y., Howell E. Jackson, Brigitte C. Madrian, and Peter Tufano. 2011. "Consumer Financial Protection." Journal of Economic Perspectives 25 (1): 91–114. <https://doi.org/10.1257/jep.25.1.91>.

Cappelletti, Giuseppe, Giovanni Guazzarotti, and Pietro Tommasino. 2013. "What Determines Annuity Demand at Retirement?" Geneva Papers on Risk and Insurance 38: 777–802. <https://doi.org/10.1057/gpp.2012.43>.

Chalmers, John, and Jonathan Reuter. 2012. "How Do Retirees Value Life Annuities? Evidence from Public Employees." Review of Financial Studies 25 (8): 2601–34. <https://doi.org/10.1093/rfs/hhs057>.

Chou, Kee-Lee, Joachim Inkmann, Hans van Kippersluis, and Wai Sum Chan. 2016. "Assessing the Demand for Annuities in an Undeveloped Market: Evidence from Hong Kong." Netspar Discussion Paper 07/2016-23. <https://doi.org/10.2139/ssrn.2811610>.

Clark, Robert L., Melinda Sandler Morrill, and David Vanderweide. 2014. "Defined Benefit Pension Plan Distribution Decisions by Public Sector Employees." Journal of Public Economics 116 (August): 73–88. <https://doi.org/10.1016/j.jpubeco.2013.05.005>.

Dushi, Irena, and Anthony Webb. 2004. "Household Annuity Decisions: Simulations and Empirical Analyses." Journal of Pension Economics and Finance 3 (2): 109–43. <https://doi.org/10.1017/S1474747204001696>.

Dwyer, Peggy D., James H. Gilkeson, and John A. List. 2002. "Gender Differences in Revealed Risk Taking: Evidence from Mutual Fund Investors." Economics Letters 76 (2): 151–58. [https://doi.org/10.1016/S0165-1765\(02\)00045-9](https://doi.org/10.1016/S0165-1765(02)00045-9).

Eckel, Catherine C., and Philip J. Grossman. 2008. "Chapter 113 Men, Women and Risk Aversion: Experimental Evidence." In Handbook of Experimental Economics Results, 1, 1061–73. Amsterdam, Netherlands: Elsevier. [https://doi.org/10.1016/S1574-0722\(07\)00113-8](https://doi.org/10.1016/S1574-0722(07)00113-8).

Fernandes, Daniel, John G. Lynch, and Richard G. Netemeyer. 2014. "Financial Literacy, Financial Education, and Downstream Financial Behaviors." Management Science 60 (8): 1861–83. <https://doi.org/10.1287/mnsc.2013.1849>.

Finkelstein, Amy, and James Poterba. 2002. "Selection Effects in the United Kingdom Individual Annuities Market." Economic Journal 112 (476): 28–50. <https://doi.org/10.1111/1468-0297.0j672>.

<3M>. 2004. "Adverse Selection in Insurance Markets: Policyholder Evidence from the U.K. Annuity Market." Journal of Political Economy 112 (1): 183–208. <https://doi.org/10.1086/379936>.

Fonseca, Raquel, Kathleen J. Mullen, Gema Zamarro, and Julie Zissimopoulos. 2012. "What Explains the Gender Gap in Financial Literacy? The Role of Household Decision Making." *Journal of Consumer Affairs* 46 (1): 90–106. <https://doi.org/10.1111/j.1745-6606.2011.01221.x>.

Friedman, Benjamin M., and Mark J. Warshawsky. 1990. "The Cost of Annuities: Implications for Saving Behavior and Bequests." *Quarterly Journal of Economics* 105 (1): 135–54. <https://doi.org/10.2307/2937822>.

Goedde-Menke, Michael, Moritz Lehmsiek-Starke, and Sven Nolte. 2014. "An Empirical Test of Competing Hypotheses for the Annuity Puzzle." *Journal of Economic Psychology* 43 (August): 75–91. <https://doi.org/10.1016/j.joep.2014.04.001>.

Guillemette, Michael A., Terrance K. Martin, Benjamin F. Cummings, and Russell N. James. 2016. "Determinants of the Stated Probability of Purchase for Longevity Insurance." *Geneva Papers on Risk and Insurance - Issues and Practice* 41 (1): 4–23. <https://doi.org/10.1057/gpp.2015.26>.

Hagen, Johannes. 2015. "The Determinants of Annuitization: Evidence from Sweden." *International Tax and Public Finance* 22 (4): 549–78. <https://doi.org/10.1007/s10797-015-9360-5>.

Hanewald, Katja, John Piggott, and Michael Sherris. 2013. "Individual Post-Retirement Longevity Risk Management under Systematic Mortality Risk." *Insurance: Mathematics and Economics* 52 (1): 87–97. <https://doi.org/10.1016/j.ins-matheco.2012.11.002>.

Hong, Jay H., and José-Víctor Ríos-Rull. 2007. "Social Security, Life Insurance and Annuities for Families." *Journal of Monetary Economics* 54 (1): 118–40. <https://doi.org/10.1016/j.jmoneco.2006.12.008>.

Hosseini, Roozbeh. 2015. "Adverse Selection in the Annuity Market and the Role for Social Security." *Journal of Political Economy* 123 (4): 941–84. <https://doi.org/10.1086/681593>.

Hu, Wei-Yin, and Jason S. Scott. 2007. "Behavioral Obstacles in the Annuity Market." *Financial Analysts Journal* 63 (6): 71–82. <https://doi.org/10.2469/faj.v63.n6.4928>.

Hurd, Michael, and Constantijn Panis. 2006. "The Choice to Cash out Pension Rights at Job Change or Retirement." *Journal of Public Economics* 90 (12): 2213–27. <https://doi.org/10.1016/j.jpubeco.2006.06.007>.

Hurwitz, Abigail, and Orly Sade. 2019. "An Investigation of Time Preferences, Life Expectancy, and Annuity versus Lump Sum Choices: Can Smoking Harm Long-Term Saving Decisions?" *Journal of Economic Behavior & Organization*, May, S0167268119301507. <https://doi.org/10.1016/j.jebo.2019.05.011>.

Inkmann, Joachim, Paula Lopes, and Alexander Michaelides. 2011. "How Deep Is the Annuity Market Participation Puzzle?" *Review of Financial Studies* 24 (1): 279–319. <https://doi.org/10.1093/rfs/hhq080>.

Johnston, David W., Sonja C. Kassenboehmer, and Michael A. Shields. 2016. "Financial Decision-Making in the Household: Exploring the Importance of Survey Respondent, Health, Cognitive Ability and Personality." *Journal of Economic Behavior & Organization* 132 (December): 42–61. <https://doi.org/10.1016/j.jebo.2016.09.014>.

Kahneman, Daniel, and Amos Tversky. 1979. "Prospect Theory: An Analysis of Decision under Risk." *Econometrica* 47 (2): 263–92. <https://doi.org/10.2307/1914185>.

Kaiser, Tim, Annamaria Lusardi, Lukas Menkhoff, and Carly Urban. 2020. "Financial Education Affects Financial Knowledge and Downstream Behaviors." Working Paper 27057, National Bureau of Economic Research, Cambridge, MA. <https://www.nber.org/papers/w27057>.

Knoller, Christian. 2016. "Multiple Reference Points and the Demand for Principal-Protected Life Annuities: An Experimental Analysis." *Journal of Risk and Insurance* 83 (1): 163–79. <https://doi.org/10.1111/jori.12101>.

Laibson, David. 1997. "Golden Eggs and Hyperbolic Discounting." *Quarterly Journal of Economics* 112 (2): 443–77. <https://doi.org/10.1162/003355397555253>.

Lambregts, Timo R., and Frederik T. Schut. 2020. "Displaced, Disliked and Misunderstood: A Systematic Review of the Reasons for Low Uptake of Long-Term Care Insurance and Life Annuities." *Journal of the Economics of Ageing* 17 (October): 100236. <https://doi.org/10.1016/j.jeoa.2020.100236>.

Landerretche, Oscar M., and Claudia Martínez. 2013. "Voluntary Savings, Financial Behavior, and Pension Finance Literacy: Evidence from Chile." *Journal of Pension Economics and Finance* 12 (3): 251–97. <https://doi.org/10.1017/S1474747212000340>.

Lee, Kyonghee. 2016. "Analysis of Payout Choice from Individual Deferred Annuities in Korea." *Journal of Pension Economics and Finance* 15 (2): 224–48. <https://doi.org/10.1017/S1474747214000183>.

Lockwood, Lee M. 2012. "Bequest Motives and the Annuity Puzzle." *Review of Economic Dynamics* 15 (2): 226–43. <https://doi.org/10.1016/j.red.2011.03.001>.

Lusardi, Annamaria, and Olivia S. Mitchell. 2014. "The Economic Importance of Financial Literacy: Theory and Evidence." *Journal of Economic Literature* 52 (1): 5–44. <https://doi.org/10.1257/jel.52.1.5>.

Mackenzie, George A. (Sandy). 2019. "To Defer or Not to Defer (SPIA or DIA)?" *Retirement Income Journal*, May 2, 2019. <https://retirementincomejournal.com/article/to-defer-or-not-to-defer-spia-or-dia/>.

Mitchell, Olivia S., and Annamaria Lusardi, eds. 2011. *Financial Literacy: Implications for Retirement Security and the Financial Marketplace*. Oxford, UK: Oxford University Press. <https://oxford.universitypressscholarship.com/view/10.1093/acprof:oso/9780199696819.001.0001/acprof-9780199696819>

Mottola, Gary R., and Stephen P. Utkus. 2007. "Lump Sum or Annuity: An Analysis of Choice in DB Pension Payouts" Vanguard Center for Retirement Research. <https://docplayer.net/883565-Lump-sum-or-annuity-an-analysis-of-choice-in-db-pension-payouts.html>

Nosi, Costanza, Antonella D'Agostino, Margherita Pagliuca, and Carlo Pratesi. 2017. "Securing Retirement at a Young Age. Exploring the Intention to Buy Longevity Annuities through an Extended Version of the Theory of Planned Behavior." *Sustainability* 9 (6): 1069. <https://doi.org/10.3390/su9061069>.

Payne, John W., Namika Sagara, Suzanne B. Shu, Kirstin C. Appelt, and Eric J. Johnson. 2013. "Life Expectancy as a Constructed Belief: Evidence of a Live-to or Die-by Framing Effect." *Journal of Risk and Uncertainty* 46 (1): 27–50. <https://doi.org/10.1007/s11166-012-9158-0>.

Peijnenburg, Kim, Theo Nijman, and Bas J. M. Werker. 2016. "The Annuity Puzzle Remains a Puzzle." *Journal of Economic Dynamics and Control* 70 (September): 18–35. <https://doi.org/10.1016/j.jedc.2016.05.023>.

Pfarr, Christian, and Udo Schneider. 2013. "Choosing between Subsidized or Unsubsidized Private Pension Schemes: Evidence from German Panel Data." *Journal of Pension Economics and Finance* 12 (1): 62–91. <https://doi.org/10.1017/S1474747212000170>.

Previtiero, Alessandro. 2014. "Stock Market Returns and Annuitization." *Journal of Financial Economics* 113 (2): 202–14. <https://doi.org/10.1016/j.jfineco.2014.04.006>.

Purcal, Sachi, and John Piggott. 2008. "Explaining Low Annuity Demand: An Optimal Portfolio Application to Japan." *Journal of Risk & Insurance* 75 (2): 493–516. <https://doi.org/10.1111/j.1539-6975.2008.00269.x>.

Ramsay, Colin M., and Victor I. Oguledo. 2018. "The Annuity Puzzle and an Outline of Its Solution." *North American Actuarial Journal* 22 (4): 623–45. <https://doi.org/10.1080/10920277.2018.1470936>.

Salisbury, Linda Court, and Gergana Y. Nenkov. 2016. "Solving the Annuity Puzzle: The Role of Mortality Salience in Retirement Savings Decumulation Decisions." *Journal of Consumer Psychology* 26 (3): 417–25. <https://doi.org/10.1016/j.jcps.2015.10.001>.

Schreiber, Philipp, and Martin Weber. 2016. "Time Inconsistent Preferences and the Annuity Decision." *Journal of Economic Behavior & Organization* 129 (September): 37–55. <https://doi.org/10.1016/j.jebo.2016.06.008>.

Shu, Suzanne B., Robert Zeithammer, and John W. Payne. 2018. "The Pivotal Role of Fairness: Which Consumers like Annuities?" *Financial Planning Review*, December, e1019. <https://doi.org/10.1002/cfp2.1019>.

Smith, James P., John J. McArdle, and Robert Willis. 2010. "Financial Decision Making and Cognition in a Family Context." *Economic Journal* 120 (548): F363–80. <https://doi.org/10.1111/j.1468-0297.2010.02394.x>.

Sundén, Annika E., and Brian J. Surette. 1998. "Gender Differences in the Allocation of Assets in Retirement Savings Plans." *American Economic Review* 88 (2): 207–11. <https://www.jstor.org/stable/116920>.

Thaler, Richard H., and Cass R. Sunstein. 2009. *Nudge: Improving Decisions About Health, Wealth and Happiness*. New York: Penguin.

Teppa, Federica, and Pierre Lafourcade. 2014. "Can Longevity Risk Alleviate the Annuity Puzzle? Empirical Evidence from Survey Data." Working Paper. <https://archivo.alde.es/encuentros.alde.es/antiores/xviiieea/trabajos/t/pdf/85.pdf>.

van der Crujisen, Carin, and Nicole Jonker. 2019. "Pension Profile Preferences: The Influence of Trust and Expected Expenses." *Applied Economics* 51 (12): 1212–31. <https://doi.org/10.1080/00036846.2018.1527010>.

van Rooij, Maarten C. J., Annamaria Lusardi, and Rob J. M. Alessie. 2012. "Financial Literacy, Retirement Planning and Household Wealth." *Economic Journal* 122 (560): 449–78. <https://doi.org/10.1111/j.1468-0297.2012.02501.x>.

Wuppermann, Amelie C. 2017. "Private Information in Life Insurance, Annuity, and Health Insurance Markets." *Scandinavian Journal of Economics* 119 (4): 855–81. <https://doi.org/10.1111/sjoe.12189>.